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Lurking and learning: Making learning visible in a Virtual Design Studio

Derek Jones
The Open University
Walton Hall
Milton Keynes
MK7 6AA
Derek.jones@open.ac.uk

Lotz Nicole
The Open University
Walton Hall
Milton Keynes
MK7 6AA
Nicole.Lotz@open.ac.uk

Holden Georgy
The Open University
Walton Hall
Milton Keynes
MK7 6AA
Georgina.Holden@open.ac.uk

This paper explores certain types of student behaviour in design courses presented through an online distance learning environment and using a virtual design studio. It demonstrates that types of behaviour often considered to be passive, and therefore negative or less valuable than obviously active behaviours, can be significant evidence of student learning. Specifically, viewing other students' work is demonstrated to be a stronger (or equal) correlation of student success compared to any other behaviour measured in the virtual design studios studied. It is hypothesised that this activity is part of a larger set of social learning behaviours that contribute to a general social press or 'ecology' of studio learning. This finding has important implications for the design and implementation of virtual studios (technically and in learning design) and these are reported specifically for the interest and use of learning designers.

Distance education; design education; Virtual Design Studio; social learning.

1. INTRODUCTION

This paper presents on-going work from a large-scale study of design students in a Virtual Design Studio (VDS) at The Open University in the United Kingdom. It builds on previous work undertaken by the research team and more specifically the finding in Lotz et al. (2015): that a form of social learning through peer comparison is taking place. This paper presents updated results from additional studios in other cohorts of the course, verifying and extending the original finding.

The student actions and behaviour studied are shown to represent a valuable, but under-represented, learning activity and opportunity, a finding reported previously (Beaudoin, 2002; Dennen, 2008; Schneider et al., 2013). Future work will explore the detail of this activity but these early results have important implications for the design of virtual studios and learning activities, which are set out at the end of the paper.

2. BACKGROUND AND CONTEXT

The context of this study is design courses run at the distance learning institution The Open University UK (OU). The OU is the largest provider of distance education in the UK with over 100,000 students. Students study individual courses (or

modules) at a distance, towards a degree level qualification. Each design module represents 60 CAT/REF points of study, equivalent to half a traditional university year. OU modules have student populations of hundreds (sometimes thousands) of students – the entry-level design module (U101) has around 3-500 students in each presentation with two presentations each year.

The Open University operates an open access policy; any student may enrol on courses without any prerequisite entry qualifications. Where there are exceptions (e.g. advanced level subject-specific courses), alternative level study is always available. OU students typically study part time and their demographic makeup is different to that of design courses in other institutions – typically OU design students are older and have a higher proportion of additional educational requirements. The courses are non-selective which leads them to be aimed at novice designers with aspirations to develop design thinking and practice. Thus the entry level module is founded on the intention of instilling design practice methods applicable to a range of disciplines not traditionally associated with 'pure' design subjects (Lloyd, 2011).

Students are allocated to a tutor group of around 20 peers supported by a part-time tutor responsible for subject tuition and pastoral care for that group.

The tutor-student relationship is one key factor in being able to scale this educational model whilst still retaining an appropriate level of individual student attention and support. Tuition is undertaken through a range of communication modes (online conferencing, phone, text, email, forums, social media, etc.).

One major mode of tuition is assessment and feedback. Students submit work through an online, centralised system which is then assessed by their tutor and returned through this same system. Tutors provide tuition through extended, detailed feedback on this work, allowing them to focus on a student's specific learning needs derived from the work and their knowledge of the student from other contact.

This provides an interesting challenge in terms of design education where the replication of synchronous learning, such as might take place in a proximate studio, is difficult to achieve. Careful consideration and design of learning material is required to ensure the optimum balance between learning, teaching and tuition. When this is achieved a suitable environment within which design can be learned is possible (Lloyd, 2012). At The Open University a key element in creating such an environment is the Virtual Design Studio (VDS), an important additional tuition space for all design modules (as well as an increasing number of other subject modules).

3. PROXIMATE AND VIRTUAL DESIGN STUDIOS

The studio is a key feature in almost all design education (Kvan, 2001; Higgins et al., 2009). It emerged from the beaux-arts traditions of Europe in response to a need to expand and systematise professional design education, principally architecture (Cuff, 1992). Such is the importance of this mode of learning that it is often argued to be a *signature pedagogy* in design and in other domains of professional education, representing both the form and content of knowledge in a particular discipline (Shulman, 2005; Crowther, 2013).

The principle characteristics of this signature pedagogy can vary depending on the authority consulted but typically involve a range of active learning methods: problem-based, experiential, performative and simulated learning (e.g. Chickering & Gamson, 1987; Bonwell & Eison, James, 1991). These are supported by a series of particular affordances: physical space/press, professional community, and access to experts (e.g. Shulman, 2005; Brandt et al., 2013). Finally, the importance of social learning and support mechanisms are now emerging in literature: peer support, evaluation, comparison and peer critique

(e.g. Cennamo & Brandt, 2012; Ashton & Durling, 2016).

Of course, these characteristics represent only the *potential* learning within the studio - precisely how such learning takes place for individual students can vary significantly. For some it may be that critique generates the most meaningful learning events; for others, it may be personal self-reflection through experiential iteration of design. In addition to these directly experienced events, learning also takes place through observation of such experiences and events. This latter mode of learning is one of the simplest forms of learning development, used from childhood. Rogoff et al. (2003) refer to this as 'listening in' and provide an interesting comparison to transmission-based education paradigms. Shulman (2005) refers to it as the 'apprenticeship of observation', demonstrating its importance in professional, practice-based learning.

In design pedagogy learning from observation is vital for developing a student's notion of what makes good or bad design. Contextual (or contingent) suitability of a design idea is very often more important than 'getting it right' and this can only be learned through exploration in a simulated (safe) environment, the design studio. More importantly it relies heavily on mechanisms of regular comparison and validation, making it an intrinsically social mode of experience and learning. The importance of developing this as a socially constructed understanding of design judgement is understood professionally and is now emerging in design education theory and literature generally (Lloyd & Jones, 2013; Ashton & Durling, 2016). Despite this there is little research that considers *specific* mechanisms of social comparison in design, for example through using models developed in social psychology (e.g. Festinger, 1954; Gilbert et al., 1995; Kruger & Dunning, 1999). In proximate studios this form of learning is often implicit and its implementation in the physical studio is assumed to take place naturally.

The studio provides a good opportunity for studying and understanding how learning through observation takes place; the locus of learning is easily identified and it has a reasonably clear focus for research. As design courses make use of virtual elements to augment or even replace studio components, this opportunity for research remains, although what learning might translate to virtual environments (and how it does so) remains an under-researched area of study (e.g. Beaudoin, 2002; Dennen, 2008; Schneider et al., 2013)

Virtual Design Studio (VDS) is a general term to denote a range of tools, systems and services used to replicate, simulate or supplement traditional

(proximate) design studios and many design programmes are now augmenting, or even replacing, traditional studio environments with virtual studios (Kvan, 2001; Arvola & Artman, 2008; Robbie & Zeeng, 2012). Most VDS spaces have been shaped by direct translation of practice in proximate studios and the affordances of the technologies available (Malins et al., 2003). In these contexts, 'virtual studio' is used to describe a place for working, i.e. a suite of design tools rather than a space for display and interaction. Other models attempt to go beyond the replication of function and use technology to support design cognition directly, such as using of virtual models as the design environment itself (e.g. Maher & Simoff, 1999).

These two models make use of the object of design in slightly different ways: the former focuses on the activity around the object and the latter on the object itself. Between these two approaches is a hybrid model of both working with and around design artefacts, a model adopted by many design

programmes around the world and the one adopted by The Open University's VDS, OpenDesignStudio.

4. OPENDESIGNSTUDIO (ODS)

OpenDesignStudio (ODS) is an online portfolio and communication space that allows students to post, view and discuss artefacts that they create and find. Digital artefacts can be uploaded to predetermined 'slots' which are presented as thumbnail previews to the entire course cohort to give a visual representation of the studio via other students' work (Figure 1). The interface is simple enough to use so that no significant time is needed for familiarisation, particularly if students are familiar with similar social media tools such as Pinterest.

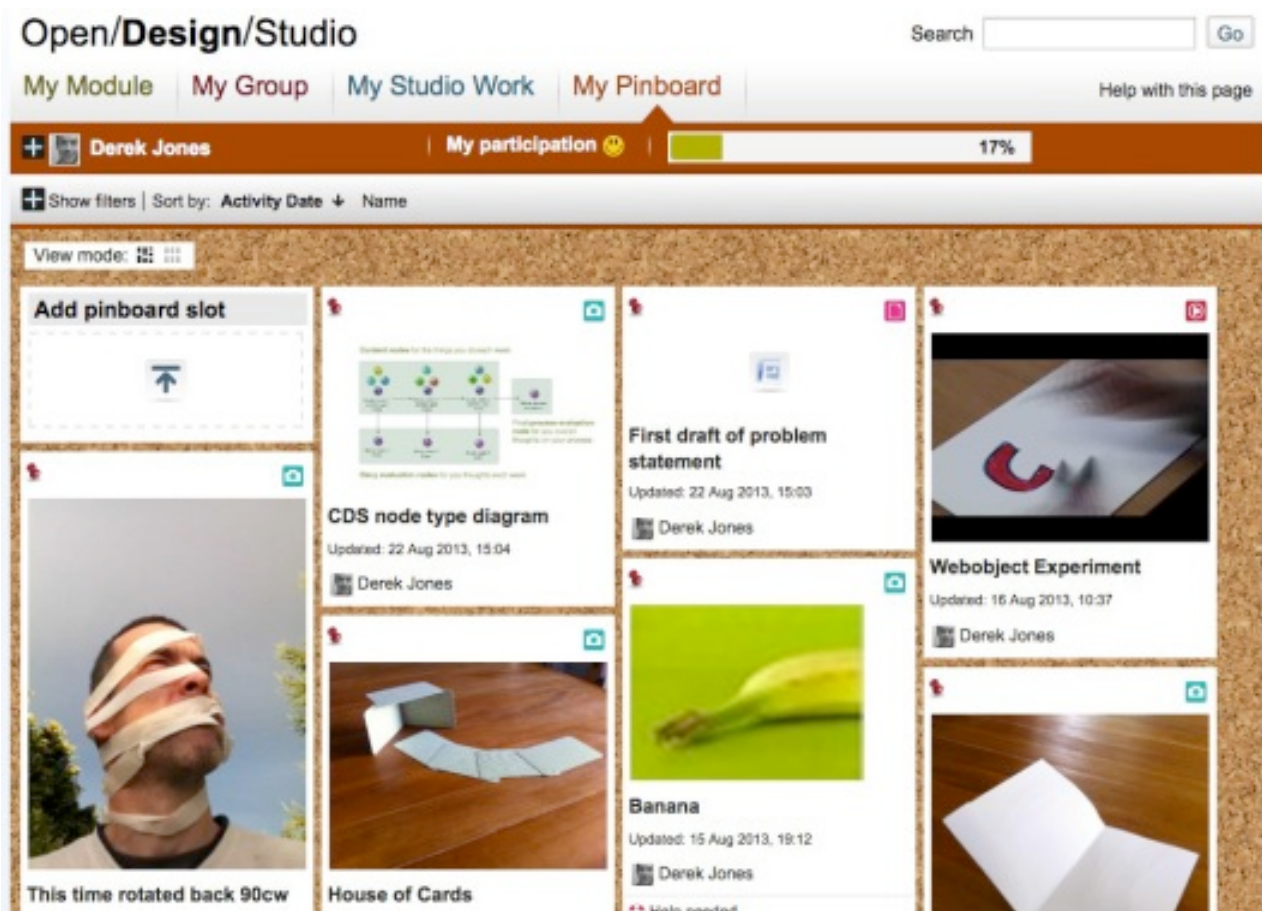


Figure 1: Main interface of OpenDesignStudio online virtual studio tool, showing predetermined 'slots'.

Clicking on a thumbnail in the main studio presents students with the slot view itself, a more detailed view of the work itself together with any text added to support it (Figure 2). Each slot can support a

range of content through uploaded file types or embedding web code. For U101, use is primarily visual through the use of image files and students can comment on individual posts using text and

audio commenting. Students can also engage in quick interaction by using Favourite, Smile and Inspire buttons that seek to encourage quick student communication and interaction. These latter actions (commenting, favouriting, etc.) are typically viewed as more active behaviours whereas the former (viewing a slot) is regarded as passive.



Figure 2: An ODS slot with image upload in OpenDesignStudio

ODS provides, a mainly visual space where students can communicate their own work activity. This is achieved using two types of slot: Studio slots (a series of named but empty slot placeholders to be completed for specific activities during the course) and Pinboard slots (a virtual 'space' where students can add as many slots of any type as they wish). Students are free to choose to engage with the tool and, whilst they are encouraged to make use of it, they do not have to do so in order to pass the course. They are also given options to enable them to maintain privacy on posts should they so wish.

Student use of ODS has far exceeded expectation from the first presentation in 2010. This informal evidence seemed to answer the question 'Can social learning take place in a virtual design studio?', a result confirmed by a number of other authors (e.g. Kvan, 2001; Malins et al., 2003; Pektaş, 2015). But our knowledge of how this takes place, to what extent, and how it compares to proximate studio learning is still relatively poor. Work on this has been taking place in a large-scale study internally funded by the OU. Initial findings and ongoing work are reported elsewhere (Lotz et al., 2015). This paper presents the most recent findings and looks specifically at student peer comparison measured by activity in OpenDesignStudio in one course: U101: Design Thinking, over several presentations.

5. APPROACH AND METHOD

5.1 Measures of engagement

When working with any asynchronous online learning tool the only way a teacher and/or researcher has to measure behaviour is through the actions taken by students using the interface. Very often these actions are treated as simple behaviours because they often have a single function or action. For example, when a user likes an online artefact it is often recorded as a single event: clicking a button, navigating to a link, or some other specific interaction with the software interface.

In any software based VDS there are limits to what can be measured. It is easy to measure which interactive features a student uses but these may not represent all the thinking and learning that has gone into a student's overall behaviour. For example, a series of slot views can be viewed as simply browsing behaviour but what, if any, intention is behind this browsing? Is a pattern being followed? A train of thought? A significant learning event?

Similarly some measures of activity are valued over others because they demonstrate a more active form of engagement: commenting or other active messaging (such as 'liking') is immediately apparent as a direct behaviour whilst simply viewing or observing is not (Dennen, 2008). Such differentials of valuing activity are essential in understanding detailed or subtler ideas of learning at a distance (Munro, 1991; Shin, 2002, 2003).

This issue of what to measure is important in a VDS and especially in this specific study of ODS. Firstly, it is necessary to check what it is we are measuring and how this helps verify and to inform learning and teaching design. Secondly, we hope to understand more of student behaviour through analysing individually unimportant actions that, when analysed in relation to one another, provide further insight. For example, when a student looks at another student's slot this is a relatively trivial indicator of behaviour – it is one instance of behaviour at one moment in time. Of far greater value is how that behaviour relates in its context: how it compares to other students; how it changes in time (e.g. as a representation of engagement); how it may build as a habitus of student practice; etc.

The importance of this 'ecology' of student activity emerged as part of the research process itself and in response to the initial starting question. At the start of the project the main hypothesis was that a correlation between engagement and success existed, but that this was also a relationship to be

explored as part of the research itself. The measure of engagement (E) per student was defined through actions taken in ODS as follows:

- Number of slots completed (slots to be completed during the course).
- Number of views of other slots.
- Number of comments made on own slot.
- Number of comments made on other slot
- Number of feedback requests
- Number of pinboard slots created

The measure of success (S) per student was by each student's individual final rank on a module which, for The Open University, is calculated based on their continuous assessment (50%) as well as a final submission of a portfolio and essay (50%).

5.2 Method

Data on the engagement measures was obtained from OpenStudios on three modules: U101, T217, and T317, each a module from levels of study 1, 2 and 3 respectively. This paper focuses only on the results from the level 1 module, U101, providing an overall dataset of 1171 students across 3 levels of study (Table 1).

Table 1: Total number of students in each presentation year and start month (B = February and J = October).

Module and presentation	Number of Students
U101 2013 J	457
U101 2014 B	255
U101 2014 J	459

These data were then analysed through general inspection of the engagement measures to identify potential patterns of interest. The underlying hypothesis that some relationship existed between engagement measures and student success was tested statistically. These results then informed a second series of correlation tests to verify and develop the relationships identified. Finally, these results were then related to qualitative data to complete the analysis.

5.3 Results and analysis

Firstly, the basic totals for each engagement measure can be seen in Table 2.

Table 2: Engagement measure totals per module.

Module and presentation	Completed slots	Views of slots	Comments (own)	Comments (other)	Feedback requests	Pinboard slots
U101 13J	12382	116670	3834	13663	790	9977
U101 14B	5547	63194	1731	6107	462	5843
U101 14J	10039	83012	2207	7886	2087	8819

A more useful and easier way of reading these figures is to consider the average of each engagement measure per student, shown in Table 3 and visualised in Figure 3.

Table 3: Average values of engagement measures per student

Module and presentation	Completed slots	Views of slots	Comments (own)	Comments (other)	Feedback requests	Pinboard slots
U101 13J	27.8	254.7	11.0	34.4	3.4	25.0
U101 14B	22.2	246.9	9.0	29.2	3.0	26.6
U101 14J	22.6	180.5	6.9	20.1	6.3	22.6

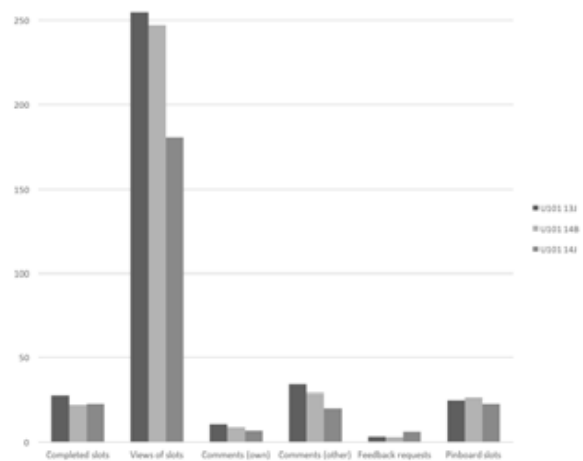


Figure 3: Average values of engagement measures per student

From these results, it is clear to see (perhaps unsurprisingly) that students view other students' slots far more than they comment on them. In fact, the ratio of viewing to commenting seems to be quite consistent (Table 4).

Table 4: Ratio of Views of slots to comments made on slots

Module and presentation	Views of slots	Comments (other)	Views to comment ratio	Pinboard slot to comment Ratio
U101 13J	116670	13663	0.11	0.09
U101 14B	63194	6107	0.10	0.09
U101 14J	83012	7886	0.10	0.11

The key difference between these behaviours is that two are clearly seen as active (commenting on slots and adding pinboard slots) and the other generally passive (viewing slots). The numbers here reveal that, regardless of how these measures are considered, there appears to be an emerging consistency in the relationships that is worth further investigation.

5.4 Correlations

To test the original correlation hypothesis, the Pearson Product Moment of Correlation between each engagement measure and student success were calculated and the results are shown in Table 5.

Table 5: Pearson Product Moment of Correlation of student engagement measures (E1-6) and success (S1) per module presentation (** $p < 0.001$; * $p < 0.05$)

Module /pres	Completed slots	Views of slots	Comments (own)	Comments (other)	Feedback requests	Pinboard slots
U101 13J	$r = -0.132^*$	$r = 0.29^{**}$	$r = 0.27^{**}$	$r = 0.25^{**}$	$r = 0.33^{**}$	$r = 0.31^{**}$
U101 14B	$r = 0.433^*$	$r = 0.35^*$	$r = 0.30^*$	$r = 0.32^{**}$	$r = 0.21^{**}$	$r = 0.40^{**}$
U101 14J	$r = 0.50^{**}$	$r = 0.50^{**}$	$r = 0.39^{**}$	$r = 0.47^{**}$	$r = 0.13^*$	$r = 0.43^{**}$

Whilst this demonstrated some reasonably strong correlations they were not as strong as originally hoped for in the starting hypothesis. Moreover, the numerical data being analysed did contain points that may or may not have been numerically large outliers in behaviour. The Spearman rank correlations were then calculated to check the Pearson results (Table 6).

Table 6: Spearman rank correlations of student engagement measures and success per module presentation

Module /pres	Completed slots	Views of slots	Comments (own)	Comments (other)	Feedback requests	Pinboard slots
U101 13J	$p = 0.079$	$p = 0.468$	$p = 0.370$	$p = 0.428$	$p = 0.399$	$p = 0.441$
U101 14B	$p = 0.422$	$p = 0.512$	$p = 0.467$	$p = 0.511$	$p = 0.400$	$p = 0.457$
U101 14J	$p = 0.463$	$p = 0.610$	$p = 0.489$	$p = 0.591$	$p = 0.198$	$p = 0.498$

These data show that the Pearson correlations seem to be generally valid and there is a reasonably linear relationship to the correlation. The higher values for the Spearman Rank are considered to be as a result of 'false outliers' – students whose activity leads to significantly higher

values but that cannot be considered true statistical outliers. For example, some students can have a number of comments that is an order of magnitude higher than others. These extreme commenters can affect the Pearson results.

The results for all engagement measures demonstrate consistently moderate correlation with student success. This correlation seems to be linear and is statistically significant for this course. But what emerged that was of interest was the comparison of correlations to one another. Generally, viewing slots is a stronger indicator of student success when compared to other measures – for the Spearman correlations, the average of views of slots is the highest of all correlations (Table 7, Column 3).

Table 7: Average Pearson Moment and Spearman Rank for engagement measures across three presentations of U101 (13J, 14B, 14B).

	Completed slots	Views of slots	Comments (own)	Comments (other)	Feedback requests	Pinboard slots
Pearson Moment	0.27	0.38	0.32	0.35	0.22	0.38
Spearman Rank	0.32	0.53	0.44	0.51	0.33	0.47

In other words, 'passive' student interaction in ODS, as indicated by *viewing* other students' slots, is the strongest and most consistent indicator of student success on this module. The second strongest indicator of student success is commenting on other students' work (Table 7, Column 5). This was expected as the original study (Lotz et al., 2015) found almost identical correlations between success and number of comments made, and to number of slot views, despite the relative difference in activity. Some students have a much higher rate of comments than others, but a majority of students can still gain good success without commenting.

Interestingly the number of Pinboard slots created result is very close to the number of views, suggesting that intrinsic motivation might be a significant factor to consider in any evaluation of possible learning mechanisms. These slots do not have to be completed, and are not assessed. They are not part of the 'structured' slots in the studio. This may indicate a more intrinsic motivation to use this space to broadcast and share ideas or it may reflect

some other conceptualisation of the studio design that has not yet surfaced.

6. CONCLUSION

In an interactive virtual design studio certain actions are normally considered 'passive' and even

referred to negatively using terms such as 'lurking' or the framing of this as something to be avoided in a learning context (Küçük, 2010; Preece et al., 2004). But the evidence and results presented here demonstrate that seemingly less active behaviours and activity can be just as (and sometimes more) valuable in different ways.

Firstly, viewing other students' work is a significant activity in the studios analysed. This supports similar findings that so-called inactive students are indeed engaging in learning activity (e.g. Beaudoin, 2002; Dennen, 2008).

More importantly, there is evidence to suggest that it is activity that students are *intrinsically* motivated to engage in. It is also clear from the sheer volume of activity that 'formal pedagogic encounters' (Webster, 2008) are unlikely to be the norm but that the activities still contribute to a positive learning experience.

Secondly, this engagement measure demonstrates the strongest correlation to student success – even over and above more apparently 'active' engagement measures such as commenting or interacting. This seems to support the idea that far from being a passive activity it may indicate a deeper level of learning engagement that is often unrecognised. What is shown here is the importance of measuring such activity – the studio researched here avoids the issue of 'not leaving a mark' noted in Dennen (2008). These findings suggest the following final recommendations:

- Recognise less active types of interaction in learning design and make use of their positive contribution.
- Avoid references to 'lurking' or other negative terms around less active modes of interaction.

- Consider encouraging less active methods and perhaps even modes of engagement.
- Enable measurement of less active behaviours in the design of interfaces or databases
- Avoid interface, database and technical designs that make tracking such activity impossible (e.g. non-tracking in slideshows, thumbnails, image browsers, etc.)
- Ensure that any online environment tracks 'passive' activity, such as viewing, and consider other such activities that might be of relevance in the specific subject.
- Use the data from less active behaviours to inform learning design and to support teachers / tutors
- The 'fingerprint' of a student's behaviour can be of significance – active behaviour might be strategic and passive behaviour can indicate much deeper learning activity.
- Maintain an understanding of these possibilities and keeping knowledge of them up to date in a learning community (e.g. through discussion between learning designers, tutors and students).

This is an important result for anyone involved in the design, implementation or running of a VDS: simple online activity in a virtual studio, such as viewing something, is potentially valuable evidence of social learning taking place.

Further work will consider the detail of possible mechanisms behind these findings but this key finding is a useful result on its own: apparently 'passive' behaviour and activity should not be ignored by teachers and learning designers of virtual design studios.

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